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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Automatic Process for Manufacturing, Filling and Evacuating Large Containers of the Tube-Bottom Type

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ABSTRACT

A new automatic process is proposed for manufacturing, filling and evacuating large containers of (square) block-bottom type up to a capacitiy of 100 liters, particularly for milk powder. In addition, an automatic packaging and evacuating machine is proposed for manufacturing such evacuated block-bottom bags. The process is preferably effected while using a thermally processable laminated foil with excellent resistance to high mechanical stress, steam, gas and light permeability, in evacuating chambers operating simultaneously, though preferably discontinuously, with an appropriate vacuum capacity. Now it is possible, e.g., to load and position three block-bottom bags of each 100 liters per each cycle in the vacated empty evacuating chamber, while interposing a reciprocating charging device moving preferably at right angles to the direction of motion of the filled block-bottom bags. After closing the chamber, the evacuating is carried out until the desired minimum end pressure is obtained. Thereafter inert gas or a gas mixture may be introduced to reduce the minimum end pressure and during this operation the opposite chamber is unloaded and loaded respectively. Synchronical control takes care of constant alternating yet continuous presence of a number of block-bottom bags in either evacuating chamber until the predetermined rate of vacuum has been reached. Vacuum sealing is then finally effected within the evacuating chamber and following decompression of the evacuating chamber. The set of preshaped block-bottom bags is transported off upon a second conveyor. In view to the space requirements it is also preferable to position and displace the off transport device in a reciprocating manner perpendicular to the direction of the movement of the bags.

(Fig. 1)

D E S C R I P T I O N

The present invention relates to an automatic process for manufacturing, filling and evacuating large containers of the tube-bottom type up to 100 l in volume, particularly for instant products and other powdered products or other hygroscopic food products such as, for example, milk powder.

Additionally, the invention relates to an automatic packaging and evacuation machine for use with the process.

The automatic process for manufacturing, filling and evacuating large containers of the tube-bottom type up to 100 l in volume, particularly for instant products and other powdered products or other hygroscopic foodstuffs such as, for example, milk powder, is novel and cannot be compared with processes already known in the art such as, for example, for vacuum-packed coffee in small packages. Nor can any comparison be made with individual evacuation chambers, because of their manual operation and manual loading and emptying.

The objective of the process according to the invention is rather to manufacture large packages, which to date have not been usual, continuously and automatically at a high rate and therefore economically, for transport and storage at minimum cost for foodstuffs that spoil quickly or which react to normal atmospheric influences. The packaging used to date, consisting of kraft/PE, provides only limited protection for products such as, for example, milk powder. On the one hand, there are problems during transport to Third World countries, caused by climatic influences, inexpert storage during and after transport, insect infestation and rapid oxidation of the product, which result in spoiling, and, on the other, there is the less than optimum use of container or storage capacity. As

a result, goods of a considerable value are lost. It was thus necessary to develop a procedure which would enable the automatic and continuous manufacture of large containers to be carried out economically and with a high output, using a sandwich foil, although major difficulties had to be overcome in so doing. Foodstuffs such as milk powder are an essential primary food for Third World countries; in the absence of any alternative, this product is at present exported in cylindrical cans. Enormous price increases in the packaging and the packaged goods, e.g. milk powder, are taking the product beyond the financial means of the broad mass of the population in Third World countries.

After exhaustive trials, it was established that with the aid of the new procedure according to the invention and using a very suitable sandwich foil, it is quite possible, despite expert opinion to the contrary, to produce large quantities of inexpensive large packages for, for example, 25 kg milk powder, which can replace the kraft/PE sack, this being used as standard to date, despite its known disadvantages.

Using the procedure according to the invention, it is now possible to fill and evacuate stackable tube-bottom containers up to 100 l in volume or, for example, 25 kg milk powder, economically in large quantities, a fact which until now was regarded by experts as absolutely impossible.

The new automatic process for manufacturing, filling and evacuating is characterised in that, when it is used, large containers are produced of the tube-bottom type up to 100 l in volume, particularly for instant products and other powdered products or other hygroscopic foodstuffs such as, for example, milk powder, using a thermally processable sandwich foil with excellent resistance to high mechanical stress, steam, gas and light permeability in evacuation chambers working simultaneously, though preferably discontinuously, with an appropriate vacuum capacity, e.g. three 100 l tube-bottom bags

per cycle, where a reciprocating charging device moving preferably at right angles to the direction of motion of the filled tube-bottom bags is provided to load the tube-bottom bags into the evacuation chamber which has just been vacated, and to position them. After the chamber has been closed, it is vacuum-loaded until a negative ultimate pressure, which can be set as required, is reached, which pressure, having been attained, can be reduced by the introduction of an inert gas or gas mixture to a negative ultimate pressure, which again can be set as required, where during this process the other chamber is emptied or filled, synchronised such that a set of tube-bottom bags remains alternately but continuously in an evacuation chamber until it has reached the preset vacuum setting in order to be sealed under vacuum in the evacuation chamber and then, after the decompression phase of the evacuation chamber, to be transferred in sets in the form of solid tube-bottom bags on to a second conveyor device, preferably such that the discharge device is summoned by the evacuation chamber which is almost ready for discharge and which therefore also preferably runs in reciprocating fashion at right angles to the direction of discharge.

The new process is implemented by an automatic packaging and evacuation machine to manufacture vacuum packages for foodstuffs which spoil easily under normal atmospheric conditions, e.g. full-cream milk powder, preferably in tube-bottom packages up to 100 l in volume, using the above-mentioned process, which is characterised in that the automatic machine forms at least one integral unit comprising the following processing stations:

a) an automatic and continuous product infeed unit

b) an automatic, high-performance metering unit

c) a tube-bottom forming, filling and closing machine working vertically from the roll, where the forming and filling tube is designed such that clean edge formation is achieved, the dropping speed of the product can be regulated,

and a solid bottom can be inserted, and where sealing tools are designed such that at the top seam a partial seal is achieved while on the bottom seam a complete seal including the bottom is achieved and folded over by means of a cooling bar.

d) a plurality of automatically operating conveyor devices with continuously variable speeds for conveying and presorting the tube-bottom bags between the filling machine and the evacuation chambers.

e) an automatic evacuation unit consisting of one or a plurality of evacuation chambers, preferably matched to the discharge of the packaging machine, but with a substantial vacuum capacity, preferably with a variable output of 400/1000 m3/h, for the simultaneous evacuation of up to several tube-bottom packs with dimensions of, for example, 600 x 340 x 240 mm per unit.

In a preferred embodiment of the automatic packaging and evacuation machine, an automatic, continuously operating product feed device is provided which loads a high-performance, large-capacity metering unit, preferably in the form of net bulk scales which in turn feed the required product quantity to a bag forming, filling and closing machine, preferably operating vertically. An integral transfer station transfers the partially closed tube-bottom bag to the conveyor unit downstream, which is responsible for transporting and formatting the tube-bottom bags. Once the required format has been attained, e.g. 3 tube-bottom bags, each containing 25 kg full-cream milk powder, the infeed belt of the evacuation stations is called up and the packs transferred. Once the machine has registered the transfer to the feed belt, lateral transport to a free evacuation chamber is initiated. When the containers reach the open evacuation chamber, flush with the conveyor belt housed therein, the transfer feed is set in motion. The tube-bottom packs not located in the evacuation chamber are registered once more, and the open half of the chamber is closed. During the closing

procedure, the packs are pressed together by the formatting plates located laterally off the conveyor belt. the "chamber closed" signal initiates the vacuum pump unit and the evacuation process begins, at which point the foil tab press device which secures the pack against movement is simultaneously activated. As soon as the preset negative ultimate pressure is reached, the negative pressure is compensated by means of an inert gas or gas mixture to an ultimate pressure which can be set as required between 0.0 and 760 torr. The signal then given releases the "sealing" function. The parallel-tracked, thermostatically controlled sealing tools are closed hydraulically with a specified pressure in order to produce a complete seal under the partial seal already available. A slitting knife located above the sealing surface and suitable for the packaging material involved cuts off the excess tab.

Once the sealing process is complete, the remaining decompression of the evacuation chamber is activated. As soon as the pressure has been equalised and registered, the evacuation chamber opens and the discharge belt is called up. The discharge belt which arrives flush with the conveyor belt permanently located in the evacuation chamber initiates the discharge of the pack, which is now solid as a result of the atmospheric pressure. As soon as the transfer to the conveyor belt travelling laterally has been registered, lateral transport to the centre, flush with a further belt leading to the palletisation station, is initiated.

Further advantages are given below with reference to the description of one embodiment of an automatic packaging and evacuation machine.

Fig. 1 shows the entire packaging and evacuation system, front view, including infeed;

Fig. 2 shows the overall system from above;

Fig. 3 shows the overall system from above, chamber 1 open;

Fig. 4 shows the automatic evacuation unit, viewed laterally in standby position;

Fig. 5 shows the automatic evacuation unit from above in standby position, chambers 1 and 2 closed, infeed and discharge belt in mid-position;

Fig. 6 shows the automatic evacuation unit, chamber 1 open, infeed unit before the open chamber, discharge belt in standby position;

Fig. 7 shows the automatic evacuation unit, chamber 1 open, discharge belt before the open chamber, infeed belt in standby position, ready for transfer;

Fig. 8 shows the automatic evacuation unit, indicating the directions of travel, with a parts description, standby position, chamber 1 open;

Fig. 9 shows the automatic evacuation unit, infeed side, standby position, both chambers closed;

Fig. 10 shows the automatic evacuation unit, infeed side, infeed device in standby position, chamber 1 open;

Fig. 11 shows the automatic evacuation unit, infeed side, infeed device ready for transfer into chamber 1;

Fig. 12 shows the automatic evacuation unit, chamber 1 loaded with tube-bottom bags;

Fig. 13 shows the automatic evacuation unit, chamber 1 open with evacuation packs;

Fig. 14 shows a lateral view of the system in accordance with Fig. 1.

The system 1, Fig. 1, by which the process according to the invention is carried out, consists of two processing stations, i.e. a filling station 2 and the automatic evacuation units 3. At the filling station 2, a sandwich foil from the roll is sealed to form a closed tube with a bottom. During the sealing process, the bottom is inserted. Once the bag is finished, it is filled via the metering unit 4 with product, e.g. 25 kg milk powder. After the filling process the tube-bottom bag 5, represented here schematically, is lowered to the transfer station 6. This transfer station 6 pushes the tube-bottom bag 5 by means of an hydraulically operated device 7 on to the first conveyor belt 8, which is responsible for conveying the bag to the second conveyor belt 9.

The second conveyor belt 9, once it is reached, advances the tube-bottom bag 5 by exactly the width of a bag plus the required spacing between the individual tube-bottom bags. When the preset number of bags is reached through sorting on the second conveyor belt, the bags are transferred to the infeed belt 10 of the automatic evacuation unit 3, which is in its standby position during this time as shown in Fig. 2. The infeed belt 10 is, as shown in Fig. 4, mounted on a frame 11 by means of two sliding rails 12, such that it can travel transversely, and the drive is provided by an advantageously hydraulic cylinder 13 which is located beneath the infeed belt 10 and is usually firmly connected at one end to the frame 11 and is connected at the other to the travelling conveyor belt 10 such that it can move with it. Further details of the design have been omitted for the sake of clarity. As soon as the chamber 14 opens, it simultaneously summons up the infeed belt 10, and this travels with the tube-bottom bags 5 sorted on it, e.g. 3 pcs., towards the open chamber 14. Once the end position is reached such that the belts are flush, Fig. 6, the infeed belt 10 and chamber conveyor belt 15 begin to run in

the same direction. Once the bags have been correctly positioned within the chamber 14, the belts stop, the chamber 14 closes, Fig. 5, and the infeed belt 10 then returns to its standby position. The "Chamber closed" signal activates the pump units 16, and the evacuation process begins. During evacuation, the bags 5 are held in position via pressure rollers 17 and shaped. When the preset negative ultimate pressure has been reached, gas in the form of an inert gas or gas mixture is reintroduced to the desired negative ultimate pressure level via shuttle valves 18. This ultimate pressure, once attained, transmits a signal to the sealing unit 19, and the ends of the three bags 5 are welded simultaneously. The completion of the end welding sequence initiates the final decompression via equalising valves 20, while the pressure roller 17 folds over the projecting tab of the packaging foil. Once standard pressure has been reestablished, the chamber 14 summons the discharge belt 21 while simultaneously opening. As soon as the chamber 14 is open, the chamber conveyor belt 15 and the discharge belt 21 begin operating synchronously. The discharge belt 21 removes the three bags 5. It then travels laterally to its standby position, Fig. 8. As soon as this standby position is reached, the transfer to the palletisation feed 22 begins. The cycle of the chamber 14 is finished. Thereafter an identical second cycle begins discontinuously, but in this case to feed the next group of sorted bags 5 into the second chamber 14' on the opposite side of the central housing 23. For the sake of simplicity, no further description of this is given.

Figs. 4 and 9-12 show how the tube-bottom bags 5 are positioned both inside and outside the chamber 14 between two upright lateral walls 24 which are located to the side of the conveyor belts 10, 15, 21.

A central processor unit 28 is provided which accurately controls all the sequential steps of the procedure mentioned above for the system 1. For further details of the system 1,

please refer to the drawings in Figs. 1 and 14. The roll of sandwich foil 29 is located on the underside of the frame 30 of the filing station 2, and the sandwich foil is guided upwards until it is formed into a tube in the area approximately under the milk powder metering unit 31. The metering unit 31 is fed by the larger milk powder hopper 32 via a feed device 33. The opening and closing of the chambers 14 and 14' is conducted by a similar drive with two hydraulic cylinders 34. Each chamber section which can open is connected with the movable section of the cylinder; the fixed cylinder section is connected to the frame 11. The drawings also show that the lateral walls 24 are adjustable at, for example, 35, so that tube-bottom bags of different sizes can be manufactured by the system 1.

C L A I M S

1. Automatic process for manufacturing, filling and evacuating large tube-bottom-type containers up to 100 l in volume, particularly for instant products and other powdered products or other hygroscopic foodstuffs such as, for example, milk powder, using a thermally processable sandwich foil with excellent resistance to high mechanical stress, steam, gas and light permeability in evacuation chambers working simultaneously, though preferably discontinuously, with an appropriate vacuum capacity, e.g. three 100 l tube-bottom bags per cycle, where a reciprocating charging device moving preferably at right angles to the direction of motion of the filled tube-bottom bags is provided upstream to load the tube-bottom bags into the evacuation chamber which has just been vacated and to position them. After the chamber has been closed, it is vacuum-loaded until a negative ultimate pressure, which can be set as required, is reached, which pressure, having been attained, can be reduced by the addition of an inert gas or gas mixture to a negative ultimate pressure, which again can be set as required, where during this process the other chamber is emptied or filled, synchronised such that a set of tubebottom bags remains alternately but continuously in an evacuation chamber and then, after the decompression phase of the evacuation chamber, to be transferred in sets in the form of solid tube-bottom bags on to a second conveyor device, preferably such that the discharge device is summoned by the evacuation chamber which is almost ready for discharge and which therefore also preferably runs in reciprocating fashion at right angles to the direction of discharge.

2. Automatic packaging and evacuation machine for the manufacture of vacuum packaging for foodstuffs which spoil

rapidly under normal atmospheric conditions, e.g. full-cream milk powder, preferably in tube-bottom bags up to 100 l in volume, using the process according to claim 1, characterised in that the automatic machine forms at least one integral unit comprising the following processing stations:

a) an automatic and continuous product infeed unit

b) an automatic, high-performance metering unit

c) a tube-bottom forming, filling and closing machine working vertically from the roll, where the forming and filling tube is designed such that clean edge formation is achieved, the dropping speed of the product can be regulated and a solid bottom can be inserted, and where sealing tools are designed such that at the top seam a partial seal is achieved while on the bottom seam a complete seal including the bottom is achieved and folded over by means of a cooling bar.

d) a plurality of automatically operating conveyor devices with continuously variable speeds for conveying and presorting the tube-bottom bags between the filling machine and the evacuation chambers.

e) an automatic evacuation unit consisting of one or a plurality of evacuation chambers, preferably matched to the discharge of the packaging machine, but with a substantial vacuum capacity, preferably with a variable output of 400/1000 m3/h, for the simultaneous evacuation of up to several tube-bottom packs with dimensions of, for example, 600 x 340 x 240 mm per unit.

3. Automatic packaging and evacuation machine according to claim 2, characterised in that the machine is controlled by interactive processors which control input data such as, for example, product quantity, bag length, pressure conditions and times, and which also call up, regulate and monitor all the necessary mechanical and hydraulic sequences until the target settings are achieved.

4. Automatic packaging and evacuation machine according to claim 3, characterised in that each evacuation chamber is formed as a tunnel-type unit and is located opposite a central housing in which, because of the short distance, the evacuation pumps or pump combinations are accommodated together with all the necessary connections, ducts and other process apparatus, where the sides are formed by the fixed rear walls of the evacuation chambers, while the other half of the evacuation chamber is a mobile chamber section provided with a sealing surface, which section is tracked on subjacent guide rails and can be moved by means of a hydraulic cylinder, and where further rails and hydraulic cylinders are provided on the front and rear sides for lateral tracking of the feed and discharge conveyor devices.

5. Automatic packaging and evacuation machine according to claim 4, characterised in that the automatic evacuation unit is integrated with a continuously operating vertical forming, filling and closing machine for tube-bottom packs up to 100 l in volume, where the packaging material consists of a sealable sandwich foil, and the unit then continues to a conveyor and positioning device with a transfer to the feed device of the evacuation chambers, which device can track laterally in two directions.

6. Automatic packaging and evacuation machine according to claim 5, characterised in that the central housing, the sections of the chamber and the feed and discharge conveyor devices which can track in two directions are all mounted on a profile section frame and all conveying motions and the opening and closing of the chamber sections are carried out by means of the hydraulic cylinders located in the support frame.

7. Automatic packaging and evacuation machine according to claim 6, characterised in that each evacuation chamber contains a fixed conveyor belt of such length that several tube-bottom bags can always be accommodated on it, with their

shape maintained by means of parallel, movable lateral guides in order to retain the desired tube-bottom shape when the chambers are evacuated.

8. Automatic packaging and evacuation machine according to claim 7, characterised in that each evacuation chamber contains a foil tab press device which, firstly, secures the packaging material against displacement and, secondly, ensures that the top of the pack is flattened.

9. Automatic packaging and evacuation machine according to claim 7, characterised in that each evacuation chamber contains parallel-tracked, height-adjustable sealing tools with an integral slitting knife, where the tools are preferably located horizontally and operated hydraulically.

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Ottawa, Canada
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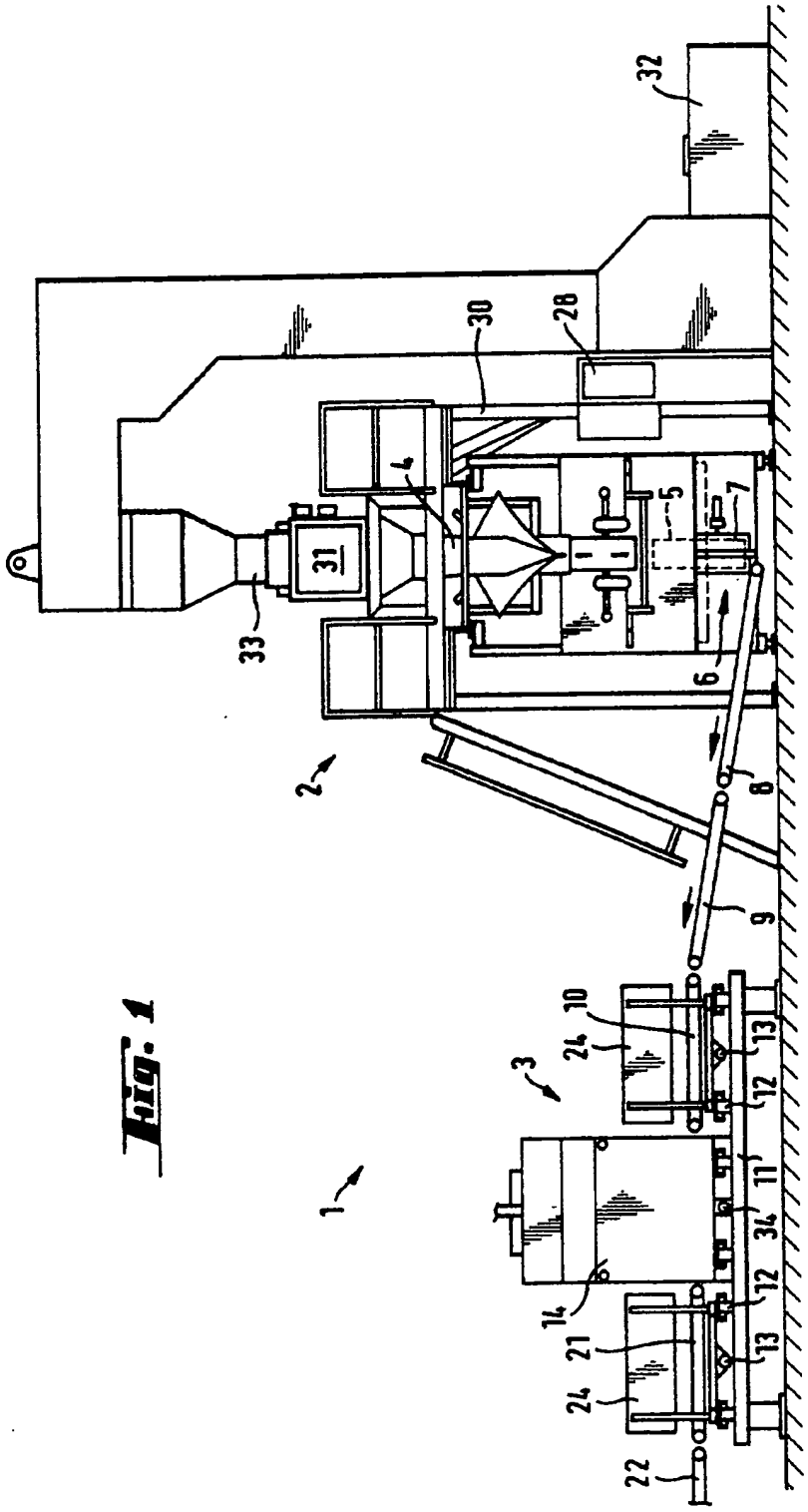

Fig. 1

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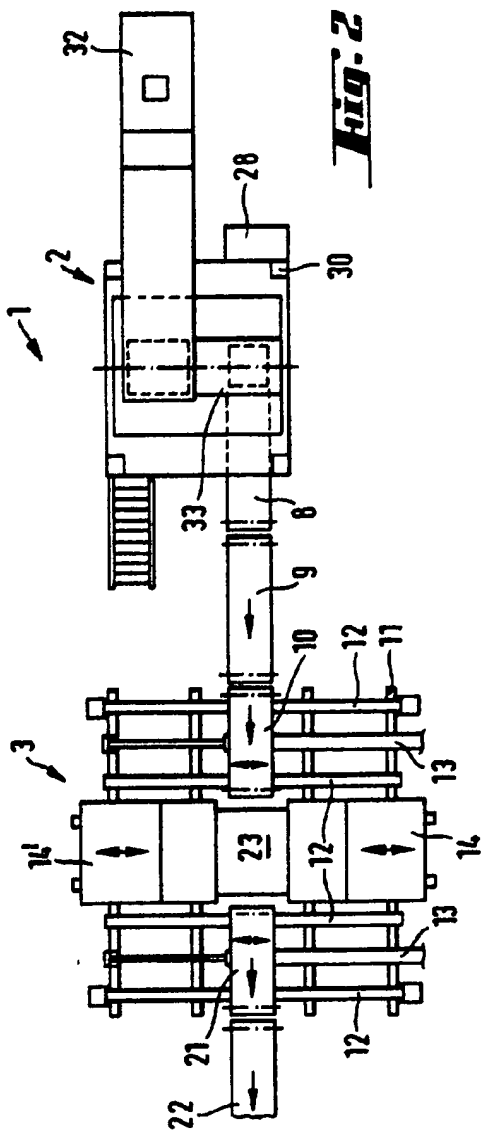
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Fig. 2

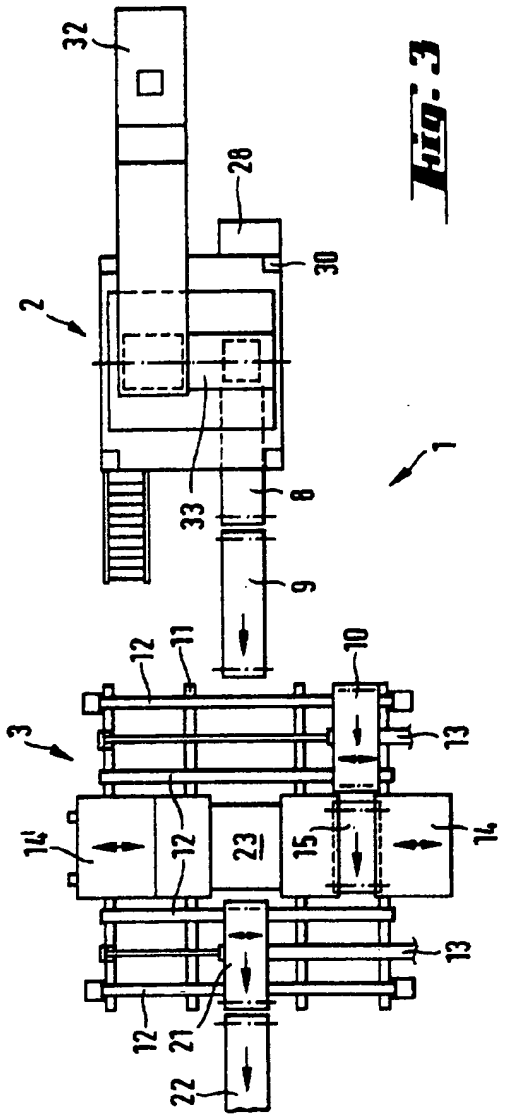
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Fig. 3

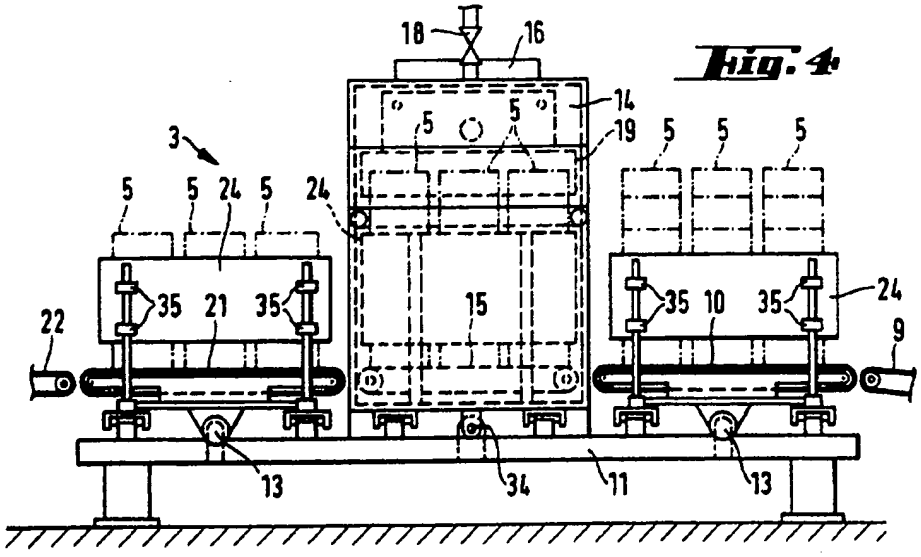

Fig. 4

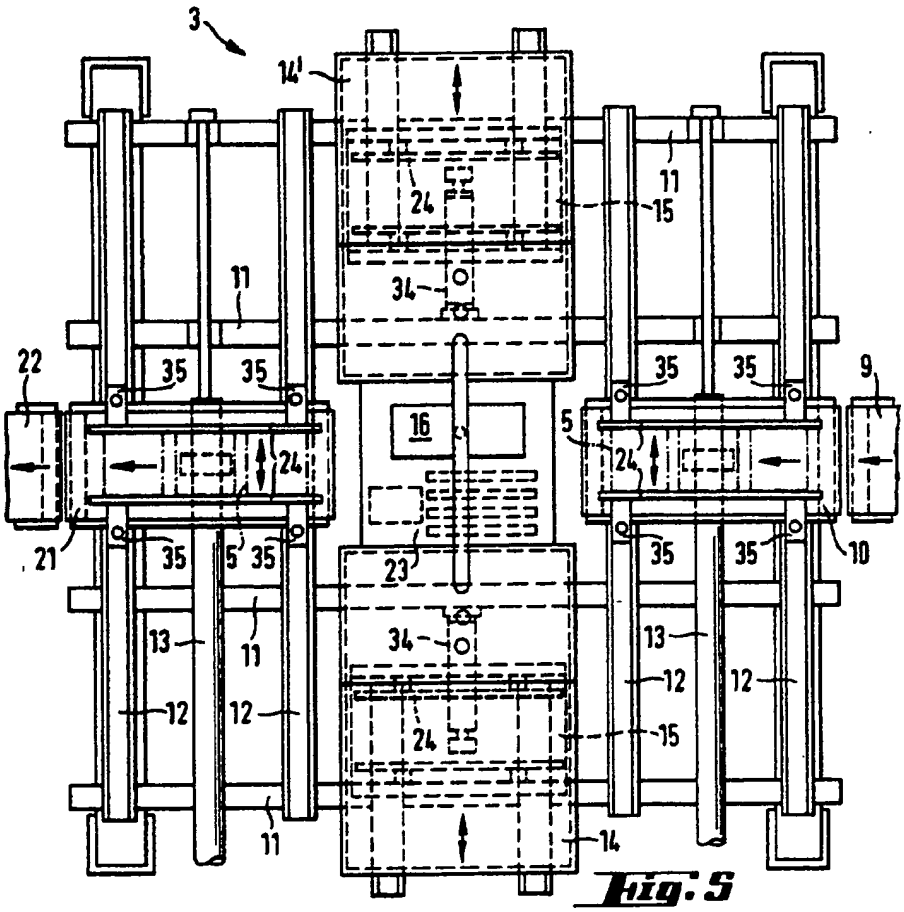

Fig. 5

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Fig. 6

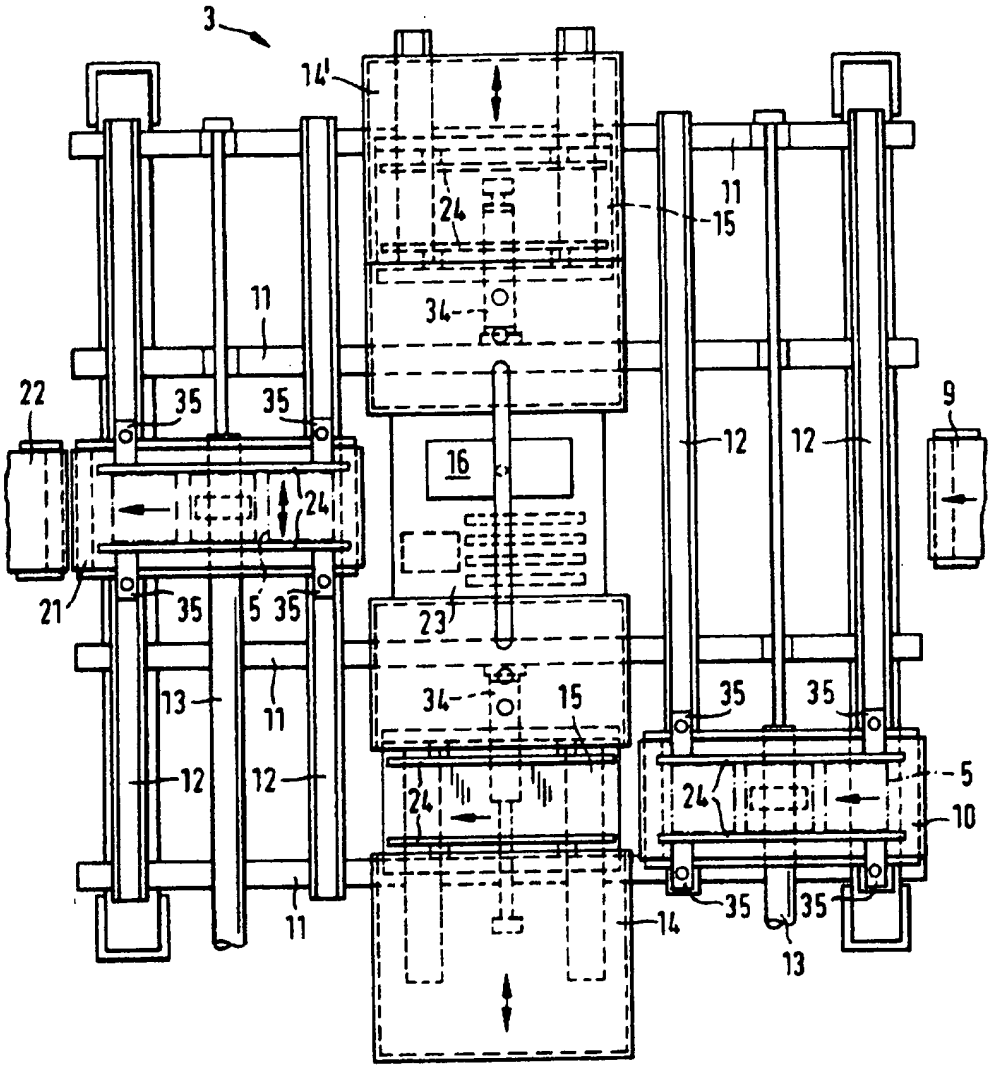
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Fig. 1

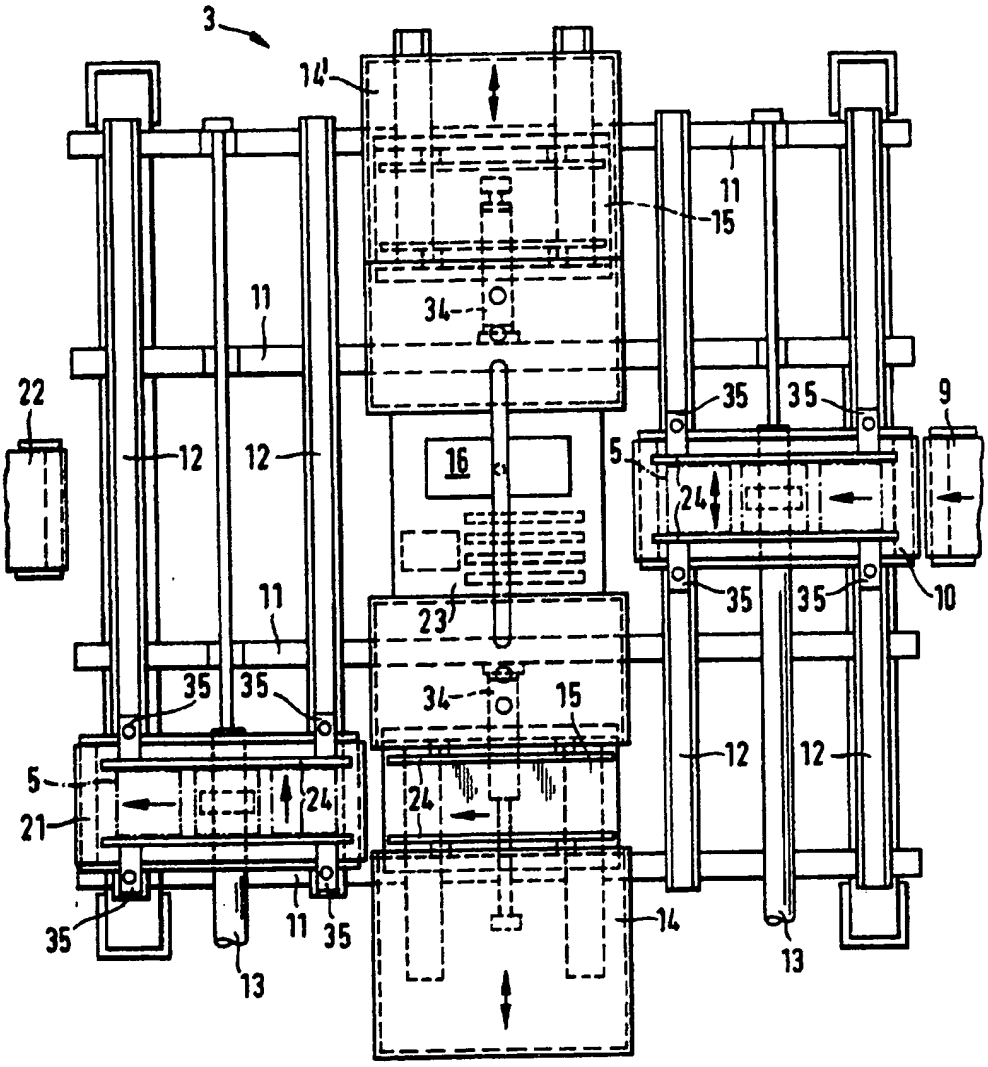
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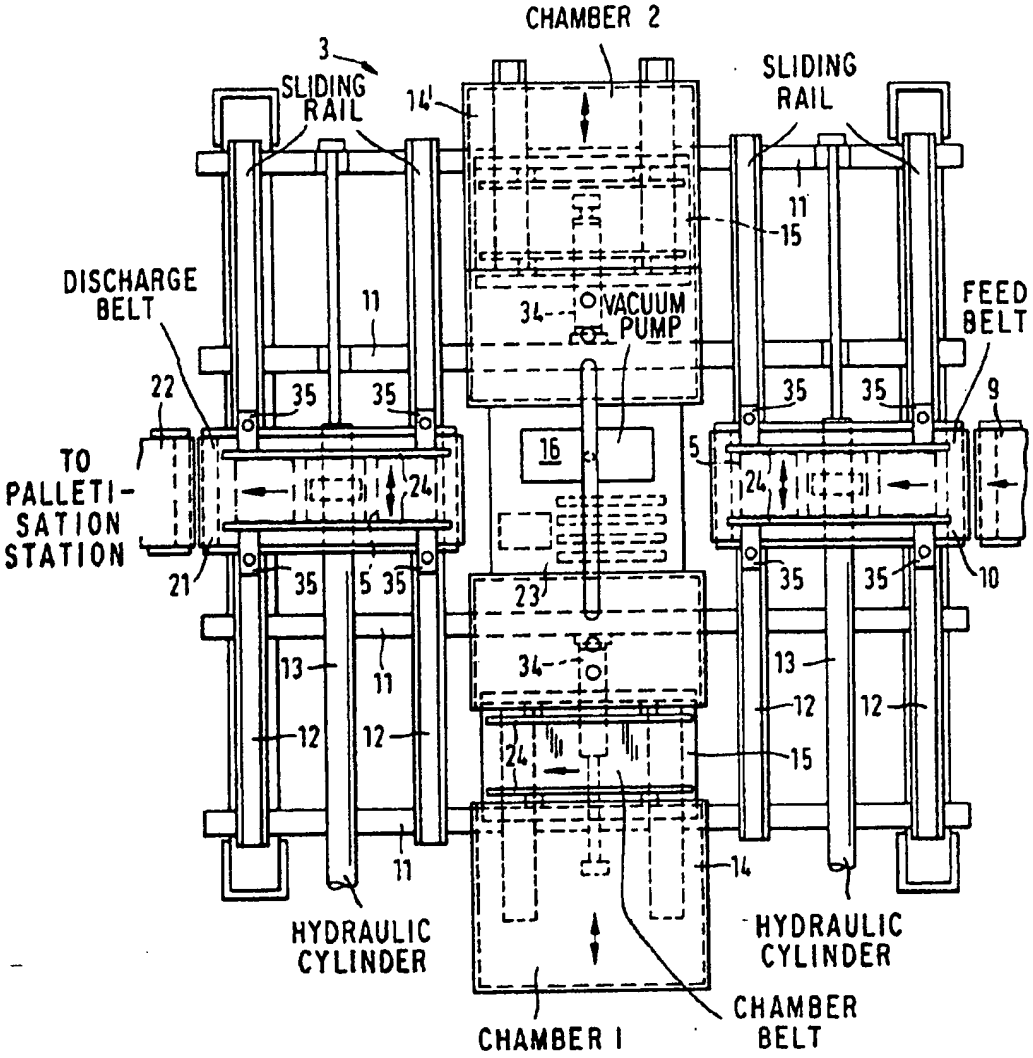
Fig. 8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SLIDING RAIL
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VACUUM PUMP
FEED BELT
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HYDRAULIC CYLINDER
HYDRAULIC CYLINDER
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CHAMBER BELT

Fig. 8

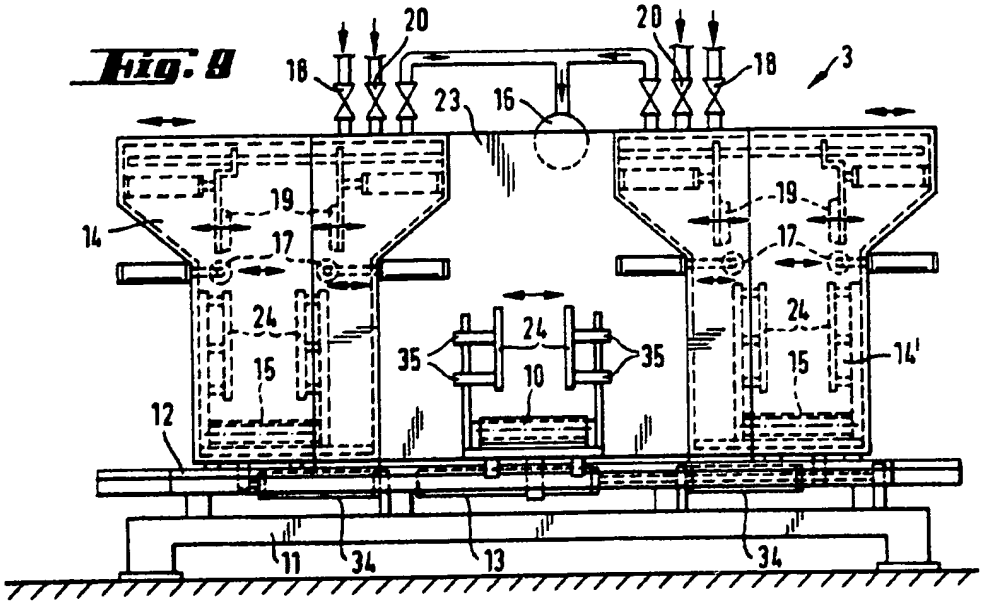
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Fig. 10

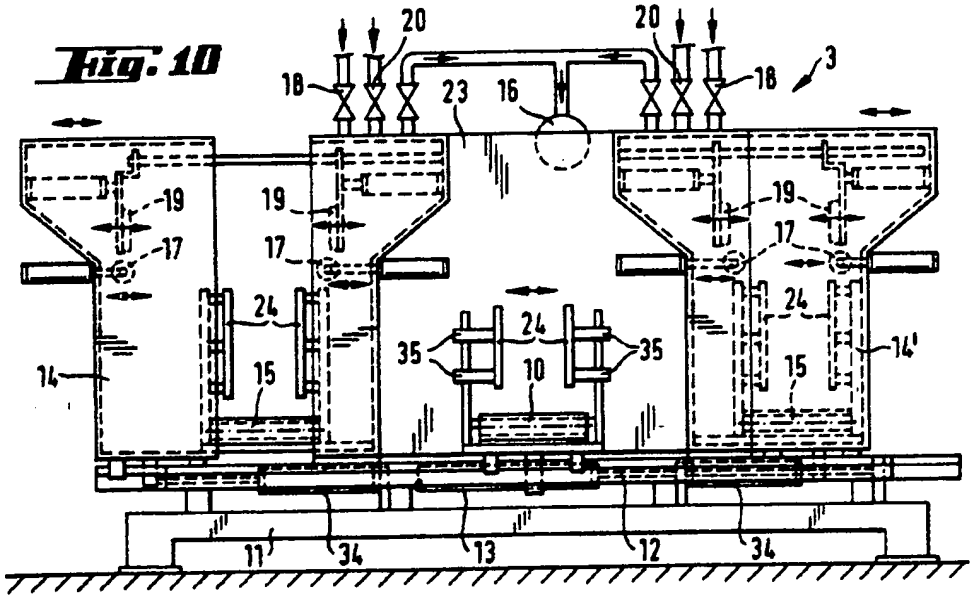
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Fig. 11

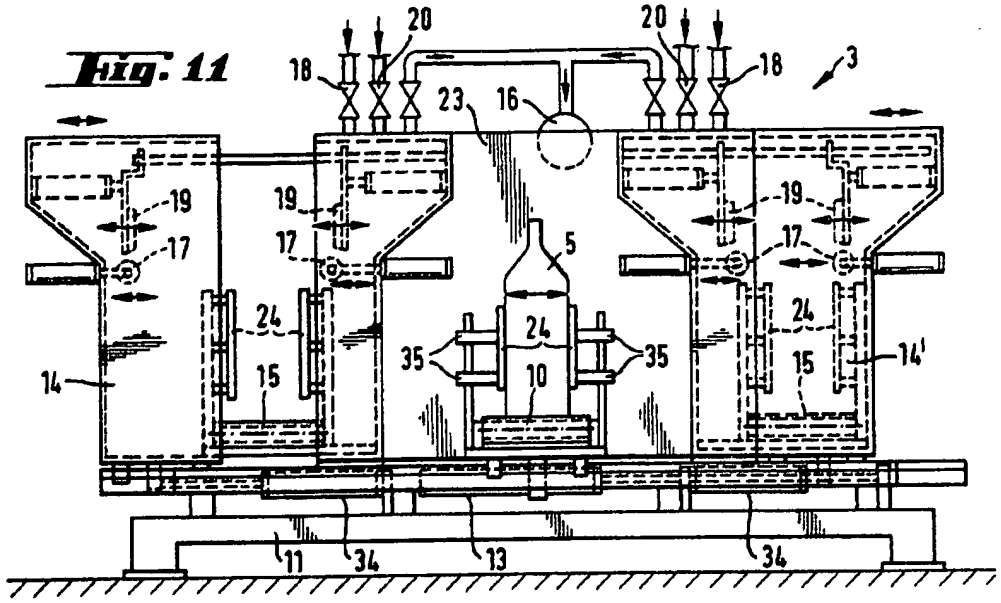

Fig. 12

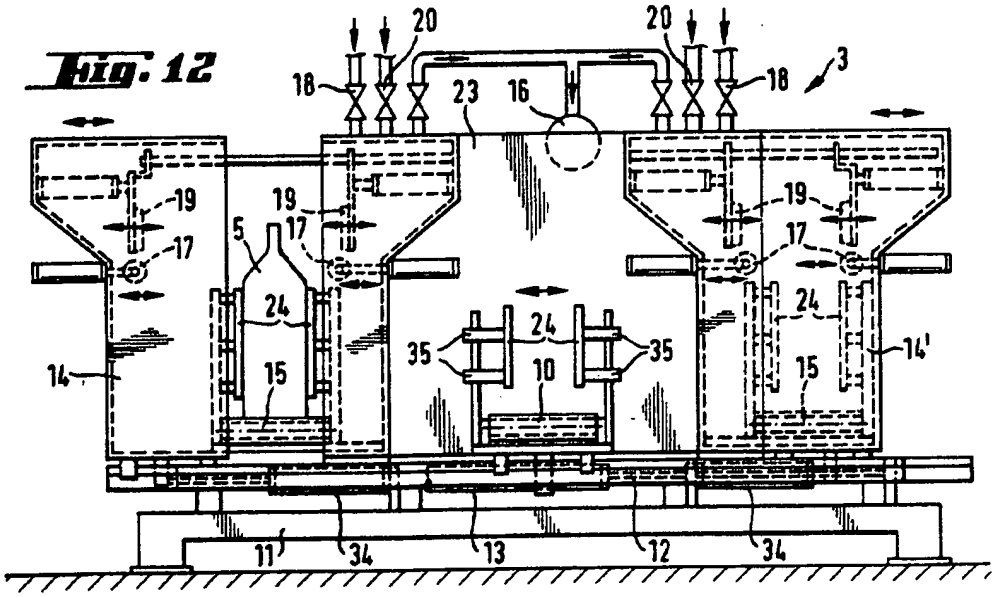

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Fig. 13

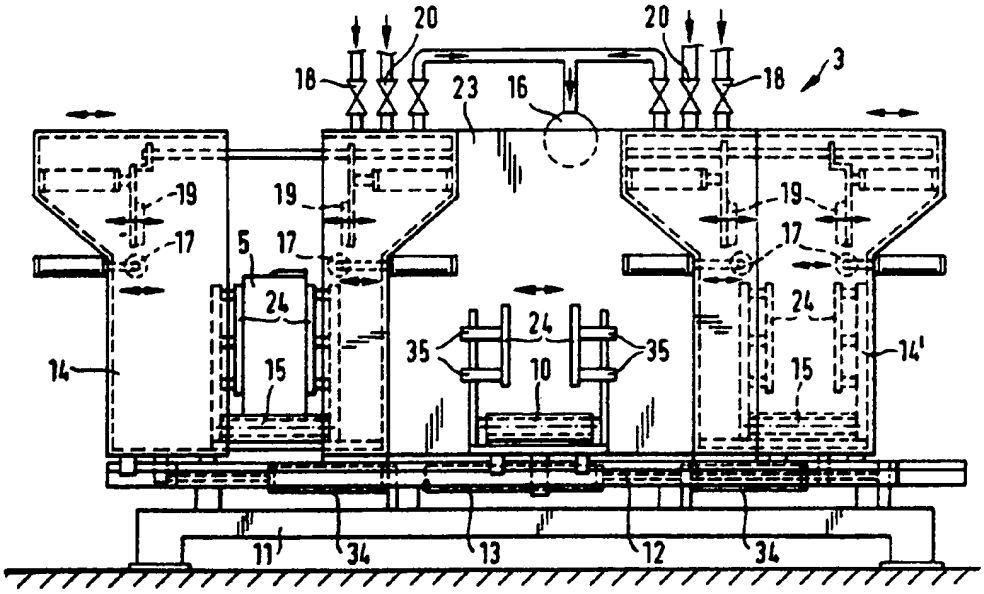
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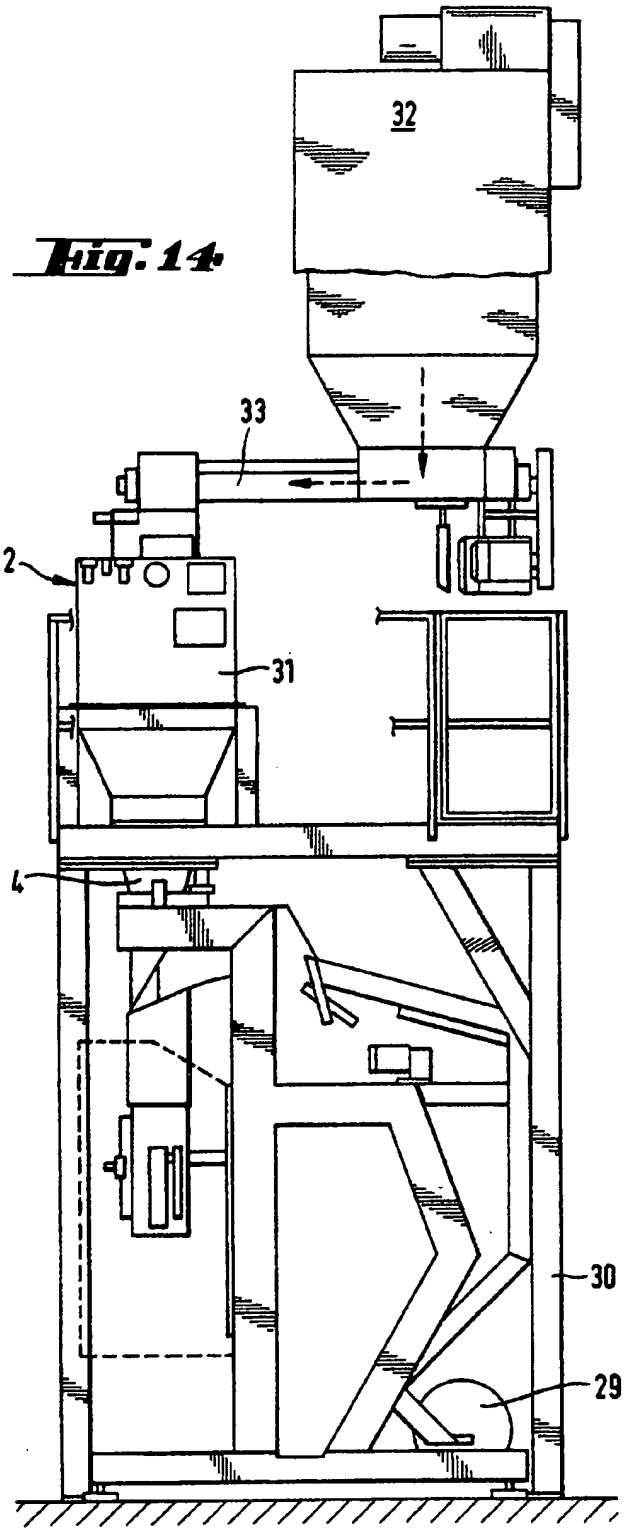
Fig. 14



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